

local societies throughout the country could participate to some degree. The local archæological societies have done good work, but in the present state of our knowledge there is great need that their work should be standardised and given direction on a more or less common basis. This object might be attained by a system of affiliation and co-operation, more close than any now existing, with some central body such as the institute here suggested.

Astrology.

- (1) *The Mediaeval Attitude toward Astrology, particularly in England.* By Theodore Otto Wedel. (Yale Studies in English. No. lx.) Pp. vii+168. (New Haven: Yale University Press; London: Humphrey Milford: Oxford University Press, 1920.) 10s. 6d. net.
- (2) *Opera hactenus inedita Rogeri Baconi, Fasc. v. Secretum Secretorum cum glossis et notulis; Tractatus brevis et utilis ad declarandum quedam obscure dicta.* By Fratr̃is Rogeri. Nunc primum edidit Robert Steele. Accedunt versio Anglicana ex Arabico edita per A. S. Fulton. Versio retusta Anglo-Normanica nunc primum edita. Pp. lxiv+317. (Oxford: Clarendon Press.) 28s. net.

THE attitude of man towards Nature may be said to have two stages—the “magical” and the “scientific.” In the former, man lives in a world surrounded by other ill-defined beings and powers. From time to time he finds, or thinks he finds, some way to make these subserve his will, but he has as yet no apprehension of a constant relation of cause and effect. In the later, scientific stage—which first presents itself clearly to our view in the Ionian philosophers of the sixth century B.C.—a belief has arisen in natural law, in an invariable relation of cause and effect. Perhaps the most important step in the journey towards this belief was the discovery of the regularity in the movements of the heavenly bodies. The laws that these movements exhibit had long been the subject of organised observation in the Mesopotamian civilisations from which the Ionians inherited a wealth of data. But the Greeks had a passionate, almost an instinctive, belief in natural law, though few such laws had been demonstrated. Perceiving the majestic and regular recurrence of heavenly phenomena, they learned to predict them. They saw, too, that winter and summer, seed-time and harvest, day and night, and all the other broadly cyclic events of life, could be brought into some sort of relation with the heavenly cycle. Outside and beyond

these there were, indeed, innumerable less regular and unpredictable phenomena, for there was as yet no biology, no chemistry, practically no physics, and scarcely any mathematics. What more reasonable than to attribute a relation between the phenomena observed to be cyclic and those the laws of which were yet unknown? Natural laws there must be, and the field of the known was but extended into the unknown. Thus astrology was born.

Later a definite geocentric spherical system of the universe was introduced—a system that held its own right down to Copernicus and Galileo and beyond. The earth was surrounded by those mysterious concentric spheres in which the stars and planets held their place—the heavenly bodies considered by the greatest of the philosophers to be eternal and divine. Spatially the universe was limited; outside the outmost sphere was nothing; within the inmost sphere was the little world on which we live. To such a view the theory of astral and planetary control of our world was attractive, satisfying, well-nigh inevitable. It needed only verification, but verification was not the strong point of the scientific system of antiquity, still less of the Dark and Middle Ages which followed. The belief in the value of astrology thus remained almost universal from Greek times until the seventeenth century. It is unfair to regard it as a superstition. It is but a discarded and untenable scientific hypothesis.

Astrology, however, had a foe, and that foe was the Church, or rather the Churches. But the opposition of the Churches must not be accounted to them for scientific righteousness; rather it was the other way. The Churches were ever insistent on man's dependence on God. How, then, could man's existence be regulated by the action of the stars that were but God's creatures? Yet as time went on the opposition of all religions, Christian and other, gradually weakened. It became evident that even God Himself worked through agents, and why should not these agents be the stars that He had made? Thus room was made for the acceptance of astrological belief, which from patristic times onward gained steadily on men's minds. In the twelfth and thirteenth centuries, as the great Arabian revival of learning penetrated to the West, astrology became a highly elaborate science; by the fifteenth century, with the ebb of the scholastic movement, it had become a widespread obsession that infected alike the university, the council chamber, the law court, and the physician's consulting-room.

- (1) The general history of this extraordinary

error is outlined by Mr. Wedel with a wealth of learning and an aptness of illustration that are a credit to American scholarship. His little volume betrays an enormous amount of research presented in an attractive and succinct manner that is a model for work of this kind. Especially praiseworthy is the logical and efficient distinction between material necessary for his narrative and the equally important material, needed by the specialist for verification and reference, that is rightly relegated to his ample notes; it is a distinction which is all too rarely made. Mr. Wedel is to be congratulated on a very able and readable contribution to the embryology of science.

(2) A much more difficult, though perhaps less thankful, task has been performed by Mr. Robert Steele. His edition of the version of the pseudo-Aristotelian "*Secretum Secretorum*" used by Roger Bacon, with notes by the father of English science himself, is a definitive contribution to our knowledge of the medieval attitude towards phenomena. This volume forms the fifth and largest fascicule of Mr. Steele's fundamental and valuable series of the hitherto unedited works of Roger Bacon. These works appeal perhaps to few readers, yet they are of permanent value as among the earliest documents of the re-birth of science.

With our present standards of historical and textual criticism it is at first incomprehensible that a great intellect like Bacon's could have taken this debased Arabian work for a treatise of Aristotle. With our standards of scientific verification it is equally incredible that such data as this work presents could make any appeal save to a confused and obfuscated intellect. Yet an appeal it did make, and for precisely that reason the work is of great interest, for by studying it and works like it we may reasonably hope to learn something of the mental processes with which "science" in our sense made its appearance in the modern world. These notes of Bacon were made at the turning point of his career, just before he passed from the pre-scientific to the scientific stage. He never freed himself from his belief in astrology, nor could any man entirely reject this doctrine while the geocentric theory held full sway. But Roger enunciated principles of observation and experiment which, in other hands, ultimately rendered astrological theory untenable. He never developed an adequate standard of textual criticism, but he made a strong appeal for the systematic study of languages, he formulated methods for such study, and he made remarkable and interesting attempts at grammatical analyses. These efforts of his, in other and more fortunate

hands, led to a scientific treatment of languages and of texts.

Roger Bacon stands as one of the heralds of the dawn of science, yet he has suffered much, and still suffers, from misunderstanding and neglect. Some of his most interesting works are still unprinted, and their publication is one of the several important pieces of work that must be achieved before any adequate and continuous history of science can be written. Yet the editing of such works is by no means easy, for it requires, on the one hand a very special training, and on the other a wide range of different kinds of knowledge that are very rarely combined in one individual. It further demands a degree of patient endurance of toil that is rare even among professional scholars; and, lastly, it calls for an indifference to the material reward for such prolonged labours that is perhaps rarest of all. Every one of these qualities the editor of this fascicule exhibits in abundant measure; his introduction and notes are scarcely less valuable than the text itself. We can but hope that Mr. Steele will be spared to complete the task that he has undertaken—a task for which very few besides himself are properly equipped.

It would be ungracious not to mention also the valuable translation from the Arabic text by Mr. Fulton with which the volume is enriched. The book is a peculiarly fine example of the skilful, accurate, and scholarly printing which the Clarendon Press has taught us to expect from it.

CHARLES SINGER.

Physical Chemistry, Pure and Applied.

- (1) *A System of Physical Chemistry*. By Prof. W. C. McC. Lewis. (In three vols.) Vol. ii., *Thermodynamics*. Third edition. (Text-books of Physical Chemistry.) Pp. viii+454. (London: Longmans, Green, and Co., 1920.) 15s. net.
- (2) *The Determination of Hydrogen Ions*. By Dr. W. Mansfield Clark. Pp. 317. (Baltimore: Williams and Wilkins Co., 1920.) 5.50 dollars.
- (3) *The Physico-Chemical Properties of Steel*. By Prof. C. A. Edwards. Second edition, thoroughly revised. Pp. xii+281. (London: Charles Griffin and Co., Ltd., 1920.) 21s. net.
- (4) *Die Reaktionen des freien Stickstoffs*. By Prof. W. Moldenhauer. Pp. viii+178. (Berlin: Gebrüder Borntraeger, 1920.) 26 marks.

(1) **P**ROF. LEWIS'S "System of Physical Chemistry" has been reviewed in these columns on two previous occasions, in September, 1916, and in May, 1919. Only a brief notice is